



Acronyms

AFV	alternative-fuel vehicle
ALA	American Lung Association
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials
Btu	British thermal unit
CARB	California Air Resources Board
CNG	compressed natural gas
CO	carbon monoxide
CO ₂	carbon dioxide
DOE	Department of Energy, U.S.
DOT	Department of Transportation, U.S.
EPA	Environmental Protection Agency, U.S.
EPACT	Energy Policy Act of 1992
ETBE	ethyl tertiary butyl ether
FDA	Food and Drug Administration, U.S.
FFV	flexible fuel vehicle
GVW	gross vehicle weight
HC	hydrocarbon
ILEV	inherently low emission vehicle
LEV	low emission vehicle
LNG	liquefied natural gas
LPG	liquefied petroleum gas (propane)
MTBE	methyl tertiary butyl ether
NAAQS	National Ambient Air Quality Standards
NO ₂	nitrogen dioxide
NO _x	nitrogen oxides
OEM	original equipment manufacturer
PM	particulate matter
psi	pounds per square inch
RRC	Railroad Commission of Texas
SO ₂	sulfur dioxide
SO _x	sulfur oxides
SwRI	Southwest Research Institute
TEA	Texas Education Agency



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THCtotal hydrocarbons
TNRCCTexas Natural Resource Conservation Commission
ULEVultra low emission vehicle
VFCvariable fuel vehicle
VOCsvolatile organic compounds
ZEVzero emission vehicle

Definitions

A

active solar construction - A type of building construction incorporating devices or appliances that use the sun's energy. (1-3)

adiabatic - A process in which expansion or compression of a gas occurs without loss or gain of heat to or from the environment. (3-2)

advertising - The communication of information, usually paid for and usually persuasive in nature, about products (goods and services) or ideas by identified sponsors through media other than one-on-one contact. (2-4)

aerobic fermentation - A chemical reaction occurring only in the presence of oxygen in which complex organic compounds are split into relatively simpler substances. (2-3)

aftermarket conversion - A standard, conventionally fueled, factory-produced vehicle to which equipment has been added that enables the vehicle to operate on an alternative fuel; also, the process of converting such a vehicle. (2-4)

alcohol - The family name of a group of organic chemical compounds composed of a hydrocarbon plus a hydroxyl group (OH). The two simplest alcohols are methanol and ethanol. (5, 6)

allergen - A substance that causes an allergic reaction, such as sneezing or a rash in certain sensitive individuals. (4-4)

aliphatic - A compound in which carbon atoms are joined in open chains. (2-2)

alkane series - A series of open-chain (as opposed to ring-shaped) saturated hydrocarbons having the molecular formula C_nH_{n+2} . (2-1)

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alternative energy - A source of energy not traditionally used for a particular application. (1-3)

alternative fuel - Any fuel for vehicles other than the petroleum-based fuels now in conventional use; for cars, trucks, and buses, conventional fuels are considered to be gasoline and diesel. Generally, alternative fuels are alcohols, natural gas, propane, hydrogen, and electricity. (2-3)

alternative-fuel vehicle - A vehicle designed and manufactured or converted to operate in bifuel, flexible-fuel, or dedicated modes on fuels other than gasoline or diesel. (2-3)

alveoli - The tiny air sacs of the lungs where the exchange of oxygen and carbon dioxide takes place. The singular is *alveolus*; the adjectival form is *alveolar*. (4-4)

ambient - Pertaining to a surrounding or environmental quality (e.g., ambient air). (2-2)

American Lung Association - A nationwide voluntary health organization that promotes lung health in the United States through research, health education, advocacy, and community service. (4-4, p. 406)

American Petroleum Institute - The U.S. petroleum industry's primary trade association, providing policy development, advocacy, research and technical services. (p. 406)

American Society of Mechanical Engineers - An engineering organization that develops and publishes technical safety standards for equipment. (p. 405)

amortization - The process of writing off an expenditure by prorating the total spent over a certain number of years. (2-4)

anaerobic fermentation - A chemical change induced by a catalyst and occurring in the absence of oxygen in which complex organic compounds are split into relatively simple substances. (2-3)

anemia - A deficiency in the oxygen-carrying capacity of the blood. (4-4)

anode - A positively charged electrode. (3-3)

anthracite - A hard coal with a high heat content and low moisture and sulfur content. The most desirable but rarest and most expensive type of coal. (1-2)

aquifer - A stratum of earth or permeable rock that contains water. (4-3)

artificial selection - A process other than a natural process by which certain animals or plants survive and reproduce their kind, while others die or are prevented from breeding. (4-3)



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aromatics - Organic compounds whose carbon atoms are strung together in rings. The basic benzene ring has six carbon atoms and is shaped like a hexagon. A compound formed of multiple rings is called polycyclic. (2-3)

arrhythmia - An irregularity in the force or rhythm of the heartbeat. (4-4)

asthma - A lung condition characterized by wheezing, a sense of constriction in the chest, and often attacks of coughing or gasping. (4-1, 4-4)

atmosphere - The envelope of air surrounding the earth and bound to it by the earth's gravitational attraction. (4-1)

atom - The smallest unit of an element having all the characteristics of that element. Atoms contain a central, positively charged nucleus surrounded by a system of electrons. (1-1)

B

barrel - A unit of measure (volume) for crude oil and petroleum products, equivalent to 42 U.S. gallons. (1-2)

benefit - In advertising, the positive product attributes offered to customers, such as quality, low price, status, speed, or good taste. (2-4)

benzene - A six-carbon aromatic hydrocarbon used as a solvent, in manufacturing synthetic fibers and petrochemicals, and as a component of high-octane gasoline; benzene is toxic and carcinogenic. (2-2)

bi-fuel vehicle - A vehicle with two separate fuel systems designed to run on an alternative fuel and gasoline, using only one fuel at a time. (2-4)

biochemical conversion - The use of enzymes and catalysts to chemically change biological substances, e.g., the digestion of organic wastes by microorganisms to produce methane. (2-2)

biodiesel - A biodegradable transportation fuel for use in diesel engines that is produced through transesterification of oil from plants such as soybeans, rapeseed, or sunflowers; animal fat; or agricultural by-products such as rice hulls. (2-3)

biofuel - Fuel resulting from conversion of biomass, the dry remains of organisms or their wastes. Biofuels are produced from crops such as sugar cane and corn, plant matter such as seaweed and wheat straw, and waste products such as garbage, seed hulls, and sewage sludge. Biofuels include syngas, biogas, ethanol, and methanol. (2-2)

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biogas - A mixture of carbon dioxide and methane produced from the anaerobic decomposition of organic material; typically a low-quality gas with numerous contaminants. (2-2)

biomass - Organic matter such as plant materials and animal waste used for the production of energy. Examples include agricultural crops; crop-waste residues; wood, animal, and municipal wastes; aquatic plants; and fungal growth. (1-3, 2-2)

bipolar plate - In a proton exchange membrane fuel cell, a thin, hard sheet of material machined to create flow channels for hydrogen, air, or water. The electrodes and electrolyte are sandwiched between two of these plates, which are usually made of graphite. (3-3)

bitumen - A thick, crude form of petroleum found in natural seeps; also called pitch. (1-2)

bituminous coal - A relatively soft coal, the most abundant form known, with about 3% moisture. (1-2)

British thermal unit - A standard unit for measuring heat energy. One Btu is the amount of heat required to raise one pound of water 1°F at sea level. (2-2)

bronchus - One of the two large channels that lead from the trachea to smaller branches (*bronchioles*) and ultimately to the air sacs (*alveoli*) of the lung. The plural is *bronchi*; the adjectival form is *bronchial*. (4-4)

buoyancy - The tendency of a material to remain afloat on or rise in a surrounding substance. (1-2)

butane - (C₄H₁₀) A gas, easily liquefied, recovered from natural gas or petroleum. Used in residential and industrial applications, and as a raw material in the synthesis of petrochemical products. (1-2, 2-1, 2-2)

by-product - A product of a chemical reaction other than the one(s) sought. (2-3)

C

campaign - In advertising, a series of advertisements or other techniques linked by a strategy that seeks to promote a product or idea. (2-4)

capillaries - The smallest blood vessels. (4-4)

carbon - A non-metallic element found in all living things on earth. (2-1)

carbon cycle - The circulation of carbon in nature. (4-3)



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carbon dioxide - A colorless, odorless, non-poisonous gas normally present in air. One source of carbon dioxide is fossil-fuel combustion. Although CO₂ does not directly impair human health, it is a greenhouse gas that traps the earth's heat and contributes to the potential for global warming. It is vital to plants, which absorb it from the air. (2-2, 4-3)

carbon monoxide - A colorless, odorless gas, slightly lighter than air, produced by the incomplete combustion of fuels with a limited oxygen supply, as in automobile engines. Carbon monoxide is poisonous if inhaled, entering the bloodstream through the lungs and forming a compound that inhibits the blood's capacity to carry oxygen to organs and tissues. Carbon monoxide can impair exercise capacity, visual perception, manual dexterity, and learning functions. Severe CO poisoning can result in death. (2-2, 4-4)

carburetor - An apparatus for supplying an internal-combustion engine with an explosive mixture of vaporized fuel and air. (2-3, 3-2)

cardiac - Relating to the heart. (4-4)

caricature - A pictorial representation in which the subject's distinctive features are deliberately exaggerated to produce a comic effect. (2-4)

catalyst - A substance, such as an enzyme, powdered metal, or metal oxide, whose presence changes the rate of a chemical reaction without itself undergoing permanent change. Catalysts may accelerate or retard reactions. (2-3, 3-3)

catalytic conversion - A chemical reaction in which engine exhaust gases are converted to carbon dioxide and water. (2-2)

catalytic cracking - A refining process of breaking down larger, heavier, and more complex hydrocarbons into simpler and lighter molecules. (2-3)

cathode - A negatively charged electrode. (3-3)

chemical energy - Energy stored within the bonds between molecules. The most common examples of chemical energy are fuels such as gasoline, coal, and natural gas. (1-1)

chemical equation - An expression representing a chemical reaction. (2-1)

chemical reaction - The changing of a substance to other substances by the breaking of old bonds and the formation of new bonds. (2-1)

chronic - Refers to an illness of long duration or frequent recurrence. (4-4)

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city gate - The location where the pressure of natural gas in a long-distance pipeline is reduced for measurement, sale, and distribution by a local utility. (1-2)

Clean Air Act of 1970 - Federal law that established targets, standards, and procedures for reducing human and environmental exposures to a range of air pollutants generated by industry and transportation. Pollutants covered under the act are known as criteria pollutants. The law sets emissions standards for stationary sources (e.g., factories, power plants) and mobile sources (e.g., automobiles, trucks). The first modern environmental law to be enacted by any nation, it has been amended several times. (4-2)

Clean Air Act Amendments of 1990 - The extensive 1990 additions to the Clean Air Act of 1970 that, among other things, require gasoline refiners to reformulate their gasoline to meet more stringent emissions standards. The regulations also require certain fleet operators to use clean-fuel vehicles in 22 cities nationwide. (4-2, 4-3)

clean diesel - An evolving term for diesel fuel that meets lower emission specifications. Currently, the sulfur content is limited to 0.05% by weight; in California, aromatics content is further limited to 10% of volume for large refiners. (2-2)

coal - A black or brownish-black solid combustible substance formed by the partial decomposition of vegetable matter without access to air. See also *anthracite*, *bituminous coal*, and *lignite*. (1-2, 2-2)

coefficient - A whole number that appears in front of a formula in a balanced equation. (2-1)

combustion - Burning; a chemical change, usually oxidation, accompanied by the production of heat and light. (2-1)

combustion heat engine - A power system that converts heat produced by burning fuel into another form of energy that does useful work for people. Examples include the gasoline engine and the steam engine. (3-1)

compound - A substance that can be separated into simpler substances only by chemical reactions. (1-1)

compression ignition - Ignition produced by heat generated by the rapid compression of the fuel/air mixture within an engine cylinder. The form of ignition used in diesel engines. (3-2)

compressed natural gas - Natural gas that has been pressurized to between 2,000 and 3,600 psi. It is held in a container and expands when released for use as a fuel. (2-3)

compressor station - The location where natural gas is pressurized for transmission in pipelines. (1-2)



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compression stroke - The piston stroke in an internal-combustion engine during which the fuel mixture is compressed within the cylinder. (3-2)

concept - An advertising term that refers to the methodology a company uses to achieve its objectives. *See strategy.* (2-4)

conclusion - A part of an editorial in which the author summarizes his or her opinion. (2-4)

conventional energy source - An energy source traditionally used for a specific application, e.g., electricity for powering appliances and gasoline for automobile engines. (1-3)

conversion - Adjustment or re-equipping of a vehicle so it can use alternative fuels. (2-4)

cost-benefit analysis - A process people use to help decide whether to make financial investments, often in equipment or other goods. The process compares the total costs of implementing the change with the benefits, in cost savings or otherwise. (2-4)

covalent bond - Chemical bond in which two atoms share electrons. (2-1)

crankshaft - The shaft in an internal-combustion engine connected by rods to the pistons so as to change reciprocating motion to rotary motion. (3-2)

criteria pollutants - Pollutants defined in the Clean Air Act of 1970 as hazardous to human health, including lead, ozone, carbon monoxide (CO), sulfur dioxide (SO₂), oxides of nitrogen (NO_x), and particulates. (4-2)

crude oil - A mixture of hydrocarbons that exists in liquid phase in underground reservoirs and remains liquid at atmospheric pressure after passing through a separating facility. Includes liquid hydrocarbons produced from tar sands, oil shale, and other sources. (1-2)

cryogenic - Relating to very low temperatures. (pg. 418)

cylinder - Chamber in which a piston moves in a reciprocating engine. (3-2)

D

dam - A barrier constructed across a waterway to control the flow or raise the level of a body of water. Dams are often used as part of a hydroelectric generating system. (1-3)

dedicated vehicle - A vehicle designed to operate solely on one alternative fuel. (2-4)

deforestation - The action or process of clearing forests. (4-3)

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degrade - To break down into constituent compounds or elements. (1-2)

denatured alcohol - An alcohol that otherwise could be safely consumed by humans that contains a small amount of a toxic substance, such as methanol or gasoline, which cannot be removed easily by chemical or physical means. Alcohols intended for industrial use, including ethanol, must be denatured to discourage abuse by ingestion and to avoid alcoholic beverage regulation and taxation. (2-3)

Department of Energy, U.S. - A department of the federal government established in 1977 to consolidate energy-oriented programs and agencies. (p. 405)

diatomic - Having two atoms in each molecule. (4-1)

diesel - A complex mixture of hydrocarbons with a boiling range between approximately 350° and 650°F. Diesel is composed primarily of paraffins and other compounds that will auto-ignite from the heat of compression in a diesel engine. Diesel is used mainly by heavy-duty road vehicles, construction equipment, locomotives, and marine and stationary engines. (2-2)

dissipate - To scatter or disperse. (3-1)

dissociated - Describes a molecule that has been split into simpler molecules, single atoms, or ions by a process such as a change in pressure or temperature, or by an electrical current. (3-3)

distillation - The extraction of components of a mixture by condensing and collecting vapors produced by heating or otherwise evaporating the mixture. (2-3)

domestic content - Under EPACT, the percentage of fuel used in the United States that is produced in this country, Canada, or Mexico. In some contexts, domestic refers to U.S. products. (p. 405)

E

E10 - Ethanol/gasoline mixture containing 10% denatured ethanol and 90% gasoline, by volume. See also *gasohol*. (2-3)

E85 - Ethanol/gasoline mixture containing 85% denatured ethanol and 15% gasoline, by volume. (2-3)

ecosystem - A system of ecological relationships in a local environment, including relationships between organisms and the environment itself. (4-3)

editorial - A short, persuasive essay that expresses the opinions of the editor or editors of a publication. (2-4)



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editorial board - A team of editorial writers at a large newspaper. (2-4)

editorial cartoon - Illustrates in pictures what editorials state in words. (2-4)

editorial page - A page in the newspaper reserved for editorial opinion. (2-4)

editorial “we” - A term that refers to the traditional style in which editorials are written, the first person plural. (2-4)

efficiency - The ratio of the effective or useful output to the total input of any system. (3-1)

electric vehicle - Vehicle powered by electricity, whether stored in batteries or produced within a fuel cell. (1-3)

electrical energy - Energy generated by moving electrons. (1-1)

electricity - An electrical charge or current generated by friction, induction, or chemical change. (1-1, 1-3)

electrode - A conductor used to establish electrical contact in a circuit or device. (3-3)

electrolysis - The production of chemical changes by passage of an electric current through an electrolyte. (2-3, 3-3)

electrolyte - A non-metallic electrical conductor in which current is carried by the movement of ions. (3-3)

electromagnetic radiation - Energy produced by electric charge in motion in the form of rays, waves, or particles. (1-1)

electron - A negatively charged subatomic particle. (1-1)

element - Any of more than 100 fundamental substances composed of atoms of only one kind and that singly or in combination constitute all matter. Elements cannot be reduced to simpler substances by normal chemical means. (2-1)

El Niño - A climate event characterized by a large scale weakening of the trade winds and warming of the surface layers in the eastern and central equatorial Pacific Ocean. (4-3)

endothermic - A reaction involving the absorption of heat by the reactants. (2-1)

energy - As defined in physical science, the capacity to do work and change matter. Energy is neither created nor destroyed, but can change from one form into another. (1-1)

energy content - The amount of potential chemical energy contained in a fuel. (3-1)

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energy conversion - A changing of one form of energy to another, usually more useful form. (1-1)

Energy Policy Act of 1992 - The federal law that defines alternative transportation fuels and establishes much of U.S. federal alternative fuels policy. (2-3, 2-4)

energy source - A supply of energy that can be used for a particular application. (1-3)

Environmental Protection Agency, U.S. - An agency of the federal government that administers and enforces environmental laws. (2-3, 4-4)

esters - A class of compounds formed by the reaction of a fatty acid and an alcohol. (2-3)

estuary - A broad mouth of a river into which the tide flows, especially an inlet of the sea at the lower part of a river. (4-3)

ethane (C_2H_6) - A colorless, odorless, gaseous alkane that occurs as a constituent of natural gas and is used as a fuel and a refrigerant. (2-1)

ethanol - Otherwise known as ethyl alcohol, alcohol, or grain-spirit. A clear, colorless, flammable oxygenated hydrocarbon. It is used in the United States as a gasoline octane enhancer and oxygenate (up to 10 percent concentration). It is commonly derived from biomass sources such as corn. See also *E-10*, *E-85*, *gasohol*. (1-2, 2-3)

ethyl alcohol - see *ethanol*.

evaporative emissions - Hydrocarbon vapors that escape from a gasoline storage tank, from a vehicle tank during refueling, or from a vehicle fuel system. See also *exhaust emissions*. (4-1)

exaggeration - A component of an editorial cartoon in which the author overemphasizes a statement or condition to make a point. (2-4)

exhaust emissions - Sometimes called tailpipe emissions. Any substances, gases, or particles that result from fuel combustion, e.g., water vapor, carbon monoxide, and soot particles. See also *evaporative emissions*. (4-1)

exhaust stroke - The piston stroke during which the exhaust valve opens so exhaust gases can escape from the cylinder into the exhaust manifold. (3-2)

exosphere - The outermost region of a planet's atmosphere. (4-1)

exothermic reaction - A reaction in which heat is released. (1-1, 2-1)



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external-combustion engine - A heat engine (e.g., a steam engine) that derives its heat from fuel consumed outside the engine cylinder. (3-2)

extinction - the condition of a species or other taxonomic group with no living members. (4-3)

F

fact - In cartooning, a component of an editorial cartoon in which the artist uses current events or other alleged facts as the subject. (2-4)

fantasy - In cartooning, a component of an editorial cartoon in which the artist uses a make-believe scenario as the subject. (2-4)

fast fill - A type of natural gas refueling, requiring a compressor and a storage tank that allows quick dispensing of fuel. (pg. 418)

feedstock - Any raw material intended to be converted to another form by a chemical manufacturing process. For example, cornstarch is one feedstock for ethanol production. (2-3)

fermentation - See *aerobic fermentation*.

fetch - The distance the wind blows over open water or land over which the wind blows. (1-3)

fission - A nuclear reaction in which an atomic nucleus splits. (2-2)

fleet - Generally, a group of vehicles owned by a business or agency. (2-4)

flexible-fuel vehicle - A vehicle designed to operate on methanol or ethanol, gasoline, or any combination thereof. (2-4, pg. 417)

formaldehyde - A compound of the aldehyde family formed as a product of incomplete combustion in engines using gasoline, methanol, ethanol, propane, or natural gas as fuels. (2-2)

fossil fuel - Fuel derived from materials formed over millions of years from organic debris. Fossil fuels include coal, distillates of petroleum, and natural gas and its components. (1-2)

four-stroke cycle - See *Otto cycle*.

friction - The rubbing of one object or surface against another. (1-1)

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fuel - A chemical substance used to produce heat or power when burned. Materials from which nuclear energy can be extracted (such as uranium) are also called fuels. (1-2)

fuel availability - The degree to which a fuel is readily accessible by the public. (pp... 414-419)

fuel cell - A system that converts the chemical energy of a fuel, such as hydrogen, and an oxidant, such as oxygen, directly to electricity. The principal components of a fuel cell are catalytically activated electrodes for the fuel (anode) and the oxidant (cathode) and an electrolyte to conduct ions between the two electrodes. (3-3)

fuel injector - A device that mixes air and fuel by spraying them in a fine mist into an engine cylinder. (2-3, 3-2)

fuel oil - A petroleum product similar to diesel fuel. (2-2)

furnace - An enclosure or machine that converts a combustible fuel to heat. (2-2)

fusion - A nuclear reaction in which the nuclei of two atoms are merged. (2-2)

G

gamma rays - High-energy electromagnetic radiation emitted by radioactive decay. (1-1)

gaseous fuel - A combustible mixture that has neither independent shape nor volume; unless contained, it would expand indefinitely. Gaseous fuels used for transportation, such as propane and natural gas, have an advantage over liquid fuels, which must be vaporized for efficient ignition. Their disadvantage is that they must be stored in pressurized tanks. (2-3)

gasification - Any chemical or heat process used to convert a feedstock to a gaseous fuel; especially, a method for turning coal into a gas. This can be accomplished by burning the coal or extracting and gasifying the coal at a plant. (1-2)

gasohol - In the United States, gasohol refers to gasoline that contains 10% ethanol by volume. This term was common in the late 1970s and early 1980s. Future gasohol will contain 5.7% and 7.7% ethanol. (2-3)

gasoline - A mixture of volatile hydrocarbons used to operate an internal-combustion engine, produced through the distillation and other chemical transformation of petroleum. (1-2, 2-2)

gene pool - The total stock of genes in a breeding population. (4-3)

generator - A machine that changes mechanical energy into electrical energy. (1-3, 3-2)



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geothermal - An energy source derived from the earth's internal heat. (1-3)

geyser - A natural spring that spouts a column of hot water and steam into the air. (1-3)

global warming - A theory that global temperatures are now escalating due to the increase of "greenhouse gas" emissions in the lower atmosphere. (4-3)

gradient zone - The area of a solar pond that separates the surface zone and the storage zone. The gradient zone traps cool water in the surface zone and warm water in the storage zone. (1-3)

greenhouse effect - the absorption and retention of the sun's radiation in the earth's atmosphere. (4-3)

grid - An interconnected system for the distribution of electricity over a wide area, especially a network of transmission lines and power stations. (1-3)

ground-level ozone - See *ozone*. (12)

H

heavy-duty vehicles - Trucks and buses having a gross vehicle weight rating of 8,500 pounds or more. (2-4, pp. 405, 418)

horsepower - A unit that measures the power of engines, reactors, etc. One horsepower is equal to 550 foot-pounds per second, or to about 746 watts. (3-2)

hybrid vehicle - A vehicle that can run on electricity and another fuel. (1-3)

hydrocarbon - An organic chemical compound of hydrogen and carbon in either gaseous, liquid, or solid phase. The molecular structure of hydrocarbon compounds varies from the simple (e.g., methane, the main constituent of natural gas) to the heavy and complex (e.g., asphalt). (1-2, 2-1)

hydroelectricity - Electricity generated by conversion of the energy of moving water, normally water flowing from behind a dam. (1-3)

hydrogen - The simplest and lightest of the elements; exists as a colorless, odorless, diatomic gas as well as in combination with other elements. (1-1, 2-3, 3-3)

hydropower - Energy derived from bodies of water or water movement. Typically used as a synonym for electricity generated by water flowing from behind a dam. (1-3)

hypertension - High blood pressure. (4-4)